RESPONSE TO COMMENTS ON THE 1990 ANNUAL GROUND WATER MONITORING REPORT FOR REGULATED UNITS AT ROCKY FLATS PLANT

Response to Comment 1
Data turnaround times have been steadily improving in the last year. Past problems with the Rocky Flats Environmental Database System (RFEDS) and laboratory turnaround time have been addressed. It is anticipated that a much higher percentage of sample data will be available for the 1991 report.

Response to Comment 2
The uppermost aquifer, as defined under Colorado Hazardous Waste Regulations (6 CCR 1007-3, section 260.10), is an underground formation, group of formations, or a part of a formation capable of "yielding a significant amount of ground water to wells or springs." Based on a strict interpretation of this definition, the uppermost aquifer consists of the lower sandstone units of the Laramie Formation, over 1,000 feet below the ground surface at RFP. The alluvial and shallow bedrock ground water system at RFP does not qualify as an aquifer for the following reasons: 1) In many areas the surficial materials are not continuously saturated throughout the year. Wells screened in these units and springs that are groundwater discharge points for these units become completely dry. Therefore these units do not "yield significant amounts of ground water to wells or springs". 2) Certain wells are incapable of providing sufficient water for all analytical sampling suites throughout the year and therefore the screened units do not "yield significant amounts of ground water to wells or springs". 3) The hydraulic conductivity for alluvial and bedrock units has been estimated to be less than 5.3×10^{-3} centimeters per second (cm/sec) and therefore these units do not "yield significant amounts of ground water to wells or springs".

In the CFR, the uppermost aquifer is defined as the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the boundary of the facility. The alluvial and shallow bedrock ground water system at RFP consists of what are termed water bearing units. Although the water-bearing units at RFP are not aquifers, these definitions are applied here for the development of a practical ground water monitoring system that complies with the intent of the 40 CFR 264 Subpart F ground water protection regulations. The intent of this interpretation is to establish a definition of the "uppermost aquifer" that is in strict accordance with the regulatory definition.

The near-surface water-bearing units at RFP consist of alluvium, colluvium, valley fill alluvium, bedrock sandstone, and

weathered and unweathered claystone of the Laramie and Arapahoe Formations. The alluvium, colluvium, and valley fill alluvium best fit the RCRA definition of the uppermost aquifer based on their proximity to the ground surface and higher hydraulic conductivities relative to the other units. Conversely, the unweathered claystone is interpreted to be an aquitard because of its low hydraulic conductivity (on the order of 1 x 10^{-8} cm/sec). This leaves for interpretation whether sandstone and weathered claystone, which are hydraulically interconnected with the alluvial system, should be considered a part of this interpretation of "uppermost aquifer". In some locations, weathered claystone and sandstone have estimated hydraulic conductivities similar to that of the unweathered claystone and therefore are not considered a part of the "uppermost aquifer." However, because hydraulic conductivities for these units vary across RFP, and in some instances these units subcrop beneath the regulated units, they will be considered part of the "uppermost aquifer" where weathered claystones and sandstones subcrop beneath a regulated unit and where saturated sandstones subcrop beneath saturated surficial material that has been affected by a regulated unit, regardless of the location with respect to the regulated unit.

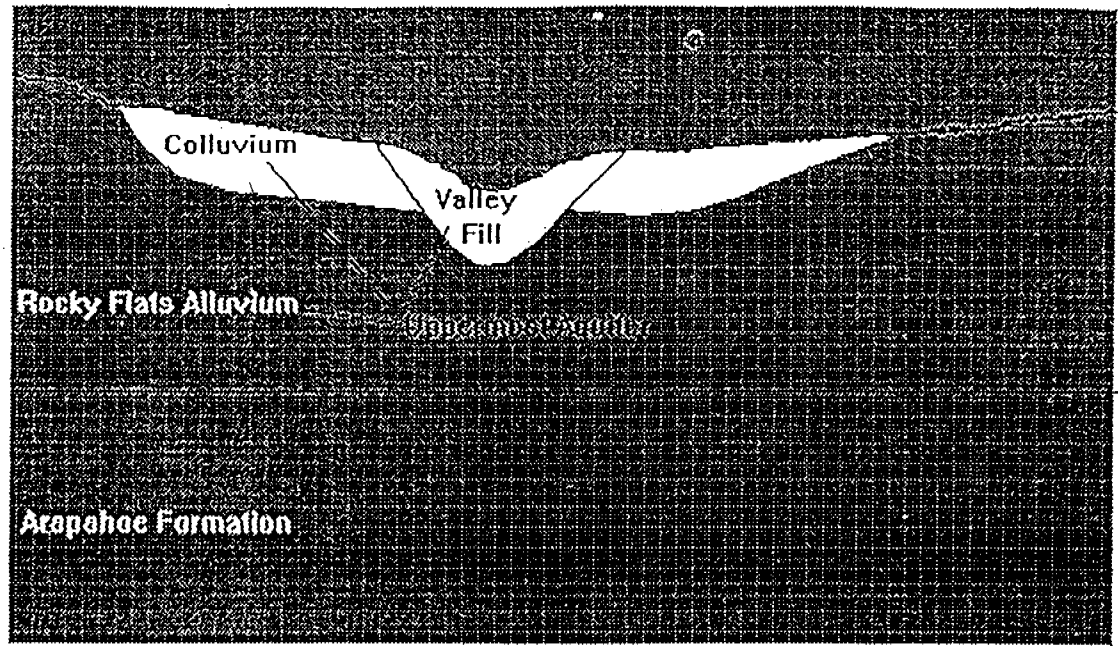
We recognize, and are in full agreement with CDH, that the RCRA Groundwater Monitoring Report for Regulated Units falls under Colorado Hazardous Waste Regulations that apply to RCRA interim status facilities.

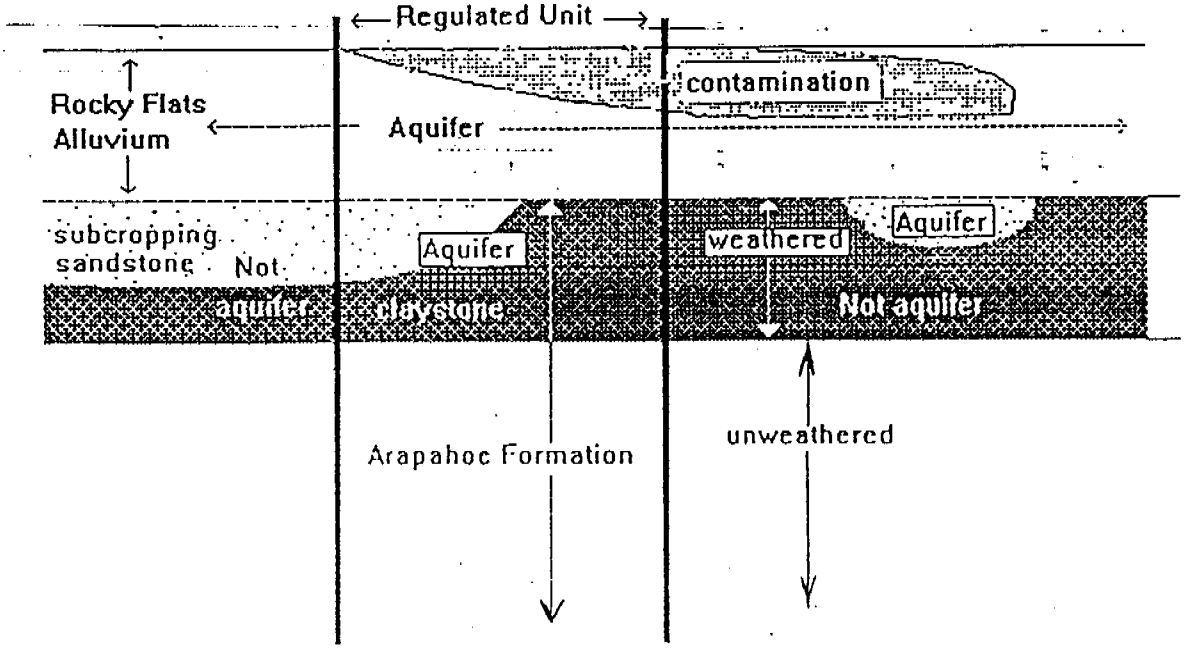
Response to Comment 3

The report states in Section 2.3 that, "In the surficial materials, groundwater flows in two directions: east through the waste management area and diverging to the northeast toward North Walnut Creek and to the east-southeast toward South Walnut Creek." The potentiometric surface maps presented in Figures 2-2 and 2-3 support this assessment. Potentiometric data from the northwest portion of the unit near wells 2286 and P209289, do suggest that a northeasterly component of ground-water flow exists there. Based on the potentiometric data, ground water in this area is moving directly towards the french drain system. The french drain is depressing potentials north of the Solar Evaporation ponds, as evidenced by the dry wells north of the unit. It is our appraisal that the french drain system is functioning as intended. Ground water in the upper-most aquifer from the northwest portion of the unit is flowing toward, and is being collected by, the drain system.

Response to Comment 4

The RCRA RFI/RI Solar Evaporation Ponds Draft Work Plan (Operable Unit No. 3) does not recommend installation of additional groundwater monitoring wells. Additional soil/vadose zone boreholes are planned for the unit and free water





Graphical representation of the Uppermost Aquifer, defined in the Response to Comment 2.

encountered in any of the planned 55 borings will be sampled during drilling. Placement of additional ground water monitoring wells will be chosen based in part on the geologic interpretation of the results from this drilling program.

The Preliminary Draft Alternate Groundwater Monitoring System Plan proposes additional upgradient monitoring wells at the Solar Ponds. Four upgradient locations have been chosen with wells constructed in clusters of three, and placed 300 feet from other upgradient wells. Complete information on proposed monitoring well locations and additional investigations is contained in the Preliminary Draft Alternate Groundwater Monitoring System Plan, October, 1991.

Detected Volatile Organic Compounds may be coming from the Mound Area, north of the 903 pad, as evidenced by potentiometric data. However, potentiometric data also suggest a southeasterly direction of ground water flow from the southeast corner of the Solar Ponds unit boundary. Potentiometric surface maps will be closely examined in the future in order to assess if well 3586 is indeed directly downgradient of the Mound Area.

Response to Comment 5
Well P209389 does show some contamination, but not nearly at the same level of concentration as well P210189. It seems unlikely that contaminants from the area of P210189 are moving in a northwesterly direction toward P209389, based on potentiometric surface data indicating a northeasterly flow direction. Another source of volatile organic compounds may exist just to the south of P209389, such as the original waste process lines.

Additionally, well P209389 does have a lower potential than well P209189 and well P210189, however, it is not *directly* downgradient of these two wells. That is, well P209389 does not lie along the same flowpath as well P209189, or well P210189. Therefore the water quality of well P209389 cannot be affected by a source near well P210189. Potentiometric surface data will be evaluated in the future to further characterize ground water flow in this area.

Response to Comment 6
See the Response to Comment 4 above for details on proposed monitoring well locations.

Response to Comment 7
Additional investigations of sandstone paleochannels in the Arapahoe Formation have been undertaken. A paleochannel is thought to occur in the northwest portion of the Solar Ponds unit. Two interpretations of the trend of this feature are currently being explored. The first suggests an easterly trend of the paleochannel with the extent of the sandstone lens on the

order of several hundred feet long and about 300 feet wide. The second proposes a longer, northeasterly trending lens. These paleochannels are discussed in greater detail in the Geological Characterization Report for RFP. This interpretation of the geology in the northwest portion of the Solar Ponds will permit a more detailed assessment of possible preferential flow paths in the area, in future reports on this unit.

In reference to the estimated linear ground water flow velocity, hydraulic conductivity (K) has been calculated as 1.2×10^{-6} centimeters per second (cm/sec). With an estimated porosity (n) of 0.1, and a gradient (i) in a southeasterly direction of 0.06 foot per foot (ft/ft), the estimated linear ground water flow velocity (v) is 0.74 feet per year (ft/yr). In a northeasterly direction, with i = 0.17 and using the same estimates for K and n, flow velocity is calculated as v = 2.11 ft/yr.

Response to Comment 8
See the Response to Comment 4 above for details on proposed monitoring well locations and additional investigations at the Solar Ponds.

Response to Comment 9
Well 5686 was completed in a siltstone in the weathered portion of the Arapahoe Formation, and is located in the Woman Creek Drainage.

Response to Comment 10
Methylene chloride was utilized in the past for decontamination of field sampling equipment, which may have caused it to be detected in the field blank samples. Methylene chloride is no longer used as a decontamination rinsing agent and has been replaced by LIQUINOX, a non-phosphate grade detergent.

Speciation (oxidation state) of chromium has not been investigated. Laboratory results are reported for total chromium.

Response to Comment 11
a) Though it is true that it has not been conclusively determined that no preferential flow paths occur in the Rocky Flats Alluvium, no evidence to date suggests that there are preferential flow paths in the West Spray Field.

b) There is a vertical component of ground water flow, however, horizontal hydraulic conductivity is several orders of magnitude higher than vertical hydraulic conductivity. Because of this, the downward migration of any potential contaminants would be minimal.

c) There is hydraulic connection from the Rocky Flats alluvium to the underlying Arapahoe and Laramie formations. However, both of these units have hydraulic conductivities that are several orders of magnitude less than the Rocky Flats alluvium. At the West Spray Field, hydraulic conductivity has been measured by the slug test method in the Rocky Flats Alluvium in the range of 3.4×10^{-3} centimeters per second (cm/s) in coarser-grained lithologies to 1.6×10^{-5} cm/s in finer-grained portions.

This can be compared with slug and packer tests performed in the Arapahoe in which hydraulic conductivity was measured from 5.4×10^{-7} cm/s to 4×10^{-8} cm/s (GW Assessment Plan Addendum, 1990). The Laramie Formation is composed of two units, an upper claystone which can exceed 700 feet in thickness and a lower sandstone. The low hydraulic conductivity and considerable thickness of the claystone make it unlikely that any plant operations could affect units below the claystone.

Because there is a hydraulic connection between the Rocky Flats Alluvium and underlying units, there is a possibility that potential contaminants may reach these lower units. However, since hydraulic conductivities are so much lower in the underlying units, migration rates are very slow and the potential for significant downward migration is negligible.

Response to Comment 12

Careful review of potentiometric data does indicate that slight mounding has occurred during March and April in the vicinity of wells B206389, 7287, and B206489 and additionally near wells 6487, 6587, and 6687. During these times, a southerly gradient of between 0.035 ft/ft and 0.05 ft/ft developed. This may have been due to differential infiltration and recharge to the alluvium during these months of normally higher precipitation. It is our appraisal that since gradients are small and the phenomenon occurs only during a brief portion of the year, there is little probability that potential contaminants would move out of the unit in a southerly direction. In future reports concerning the Present Landfill, potentiometric data from these areas will be thoroughly evaluated, and the potential for gradient reversal will be included in the conceptual model of the ground water flow system.

Response to Comment 13

Methylene chloride is no longer used at RFP, as stated in the response to comment 10. Acetone is used frequently in laboratories and may cause contamination of blank samples. Laboratories used for analysis of RFP samples will continue to be required to follow all standard operating procedures and will be expected to maintain reasonable standards of analytical technique.

The reported concentration for mercury in well 0686 was 1.4 *micro*grams per liter (µg/l), not milligrams per liter (mg/l). This value has been validated, however, it is considered highly suspicious. The field blank contained mercury, and other samples analyzed for mercury at the same time as this particular sample had exactly the same reported concentration. This suggests that a problem may have occurred in the field or at the laboratory.

Response to Comment 14

The Preliminary Draft Alternate Groundwater Monitoring System Plan lists additional investigations and proposed monitoring well locations at the Present Landfill. These include cone penetrometer tests, soil vapor tests, soil borings, aquifer tests, and additional monitoring well clusters. Some of these activities will permit assessments to be made of the affect of evaporative spraying operations on the southern portion of the landfill, as well as allow estimates of ground water flow rate to be made for the valley fill alluvium.

During wetter periods, there are increases in ground water recharge, ground water discharge to streams as baseflow, and surface water discharge. Contaminants that may be present at the Present Landfill have a greater potential for migration during these periods. One possible migration route could involve the movement of contaminants with groundwater baseflow into the unnamed tributary to Walnut Creek. These constituents might travel downstream, re-enter the valley fill alluvium, and be detected in downstream wells such as 0586 and 0686. Continued monitoring of downstream surface water and ground water, especially during wetter periods, will permit better assessment of the potential for contaminant migration via this pathway.

Response to Comment 15

As stated in the Response to Comment 2 above, the unweathered portions of the Arapahoe Formation at the Solar Ponds is not considered part of the "uppermost aquifer." A more correct heading for this portion of the table may have been "Water-Bearing Unweathered Bedrock Units Hydro-Stratigraphically Below the Uppermost Aquifer.